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ABSTRACT

Twenty variables comprising the subtests of the Frostig, Illinois Test of Psycholinguistic Ability, Appalachia Preschool Test and the Peabody Picture Vocabulary Test raw score were factor analyzed by a principal component solution and an orthogonal rotation of the factor matrix. Although the different subtests were designed to measure specific abilities, these abilities could be masked by the presence of unknown underlying factors common to these tests. Eight factors were identified: vocabulary; reasoning; general reception; identifying body parts; general cognitive skills; visual perception; auditory memory; and verbal expression. The results of the factor analysis showed that, to some extent, the factors revealed certain abilities which discriminated between groups of children tested. The effectiveness of the Early Childhood Education (ECE) Program on at least a few factors was indicated. With the exception of the category of "verbal expression," in which the comparison group scored the highest, the ECE subjects had higher factor scores. A summary of the AEL Early Childhood Program is available as PS 004 889. (Author/NH)

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FACTOR ANALYSIS OF THE EARLY CHILDHOOD

EDUCATION TEST DATA

Technical Report No. 6

Division of Research and Evaluation
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Charleston, West Virginia

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FACTOR ANALYSIS OF THE EARLY CHILDHOOD
EDUCATION TEST DATA*

Twenty variables comprising the subtests of the Frostig, ITPA, and APT (Appalachia Preschool Test), and the PPVT raw score were factor analyzed by a principal component solution and an orthogonal rotation of the factor matrix.¹ Although the different subtests were designed to measure specific abilities, it was possible that certain specific abilities could be masked by the presence of unknown underlying factors common to these tests. The results of the factor analysis showed that, to some extent, the factors revealed certain abilities which discriminated between groups.

Identification of the Eight Factors

Table 6-1 is the factor matrix showing the factor loadings of the eight factors on the twenty variables. The subtests of the PPVT, APT, ITPA, and Frostig are described in detail in the relevant technical reports--numbers two through five respectively. A brief description of each of the subtests is given in Table 6-1.

The asterisks in Table 6-2 indicate the variables with relatively high factor loadings. Accordingly, factor names were assigned to the eight factors. The factor common to many subtests was "vocabulary." It was easy to see that vocabulary was one basic ability which would account for a large proportion of the variance of most tests.

The APT Subtest 5 was a very specific test. Seventy-five percent of its variance was accounted for by factor two, "reasoning." On the other hand, about fifty percent of the variance of the APT Subtest 2 was accounted for by the factor "general cognitive skills" (factor six). Factor five "identifying body parts" accounted for about seventy-three percent of the variance

*This report was completed by Dr. Deagelia Pena of the Research and Evaluation staff.

¹The computer program used was the BMD3M "Factor Analysis with VARIMAX Rotation".

TABLE 6-1

DESCRIPTIONS OF THE TWENTY VARIABLES (SUBTESTS)
USED IN FACTOR ANALYSIS

Variable No.	Subtest Name	Description
1	Frostig Subtest 1	Hand-eye coordination in line drawing
2	Frostig Subtest 2	Figure ground discrimination
3	Frostig Subtest 3	Recognition of geometric shapes
4	Frostig Subtest 4	Discrimination of figural rotation
5	Frostig Subtest 5	Analysis and reproduction of simple patterns
6	PPVT (Raw Score)	Peabody Picture Vocabulary Test
7	ITPA Subtest 1	(Illinois Test of Psycholinguistic Ability) Vocabulary and hearing level
8	ITPA Subtest 2	Ability to match from a sample
9	ITPA Subtest 3	Vocabulary auditory association
10	ITPA Subtest 4	Association and stimuli goal
11	ITPA Subtest 5	Ability to describe objects verbally
12	ITPA Subtest 6	Vocabulary and ability to communicate gestures
13	ITPA Subtest 7	Ability to make grammatical transformations
14	ITPA Subtest 8	Figure ground discrimination
15	ITPA Subtest 9	Auditory recall
16	ITPA Subtest 10	Visual recall
17	APT Subtest 2	Test of cognitive objectives
18	APT Subtest 4	Interview (naming body parts)
19	APT Subtest 5	Cause-effect reasoning
20	APT Total (2)	Total of variables 17, 18, 19

TABLE 6-2

FACTOR MATRIX¹

	2 Reasoning	3 Visual Perception	4 General Reception of Understanding	5 Identifying Body Parts	6 General Cognitive Skills	7 Auditory Memory	8 Verbal Expression	Communality h ²
	0.14515	0.12453	0.55003 *	0.06681	0.08380	0.12018	0.08673	0.38009
	0.21029	0.66831 *	0.22553	0.15400	0.22858	0.14520	0.18606	0.69033
	0.28482	0.47333 *	0.07830	0.00813	0.12300	0.04986	0.21247	0.49345
	0.00227	0.30892	0.48034 *	-0.03473	0.07861	0.23042	-0.08440	0.43230
	0.08464	0.57583 *	0.26958	0.07131	0.16485	0.06121	-0.01340	0.53056
	0.20076	0.21865	0.17727	0.17563	0.22321	0.36408	0.37009	0.68349
	0.12388	0.10737	0.36718	0.11150	0.18669	0.08659	0.19870	0.57555
	0.09521	0.16547	0.34537	0.18399	0.11616	0.02983	0.05614	0.42895
	0.22562	0.25338	0.32123	0.13279	0.20629	0.35947	0.22045	0.78554
	0.11093	0.28539	0.24808	0.03327	0.05772	0.26497	0.17037	0.63475
	0.12248	0.20400	0.03889	0.10031	0.13222	0.03767	0.48162 *	0.42262
	0.03418	0.14571	0.02783	0.11803	0.07813	0.10333	0.07324	0.36882
	0.22913	0.18615	0.09387	0.10588	0.21603	0.20836	0.31566	0.62036
	0.07056	0.54676 *	0.15663	-0.00157	0.05937	0.11359	0.27584	0.60148
	0.11494	0.10032	0.27371	0.07692	0.06782	0.50806 *	0.04242	0.42698
	0.11916	0.28953	0.34747	0.16439	0.12054	0.03980	0.22493	0.44825
	0.26093	0.41614	0.24362	0.12195	0.73178 *	0.12874	0.20015	0.99683
	0.15181	0.07545	0.08276	0.85144 *	0.10073	0.07828	0.08748	0.82389
	0.87163*	0.22299	0.19390	0.18250	0.19276	0.14063	0.12316	0.97484
	0.49670	0.37313	0.24027	0.27240	0.58770 *	0.14060	0.18389	1.00098
								12.31967

1. The principal component solution was for ten factors but two factors with low loadings are not shown in this table, hence the slight discrepancy between the communality in the last column and the actual total sum of squares of the eight factor loadings.

2. Total score of three APT subtests--variables 17, 18, 19.

TABLE 6-2

FACTOR MATRIX¹

Factor Variable	1 Vocabulary	2 Reasoning	3 Visual Perception	4 General Reception or Understanding	5 Identifying Body Parts	6 General Cognitive Skills	7 Audition Memory
1. Frostig Subtest 1	0.08129	0.14515	0.12453	0.55003 *	0.06681	0.08380	0.1201
2. Frostig Subtest 2	0.12682	0.21029	0.66831 *	0.22553	0.15400	0.22858	0.1452
3. Frostig Subtest 3	0.16009	0.28482	0.47333 *	0.07830	0.00813	0.12300	0.0498
4. Frostig Subtest 4	0.15913	0.00227	0.30892	0.48034 *	-0.03473	0.07861	0.2304
5. Frostig Subtest 5	0.24799	0.08464	0.57583 *	0.26958	0.07131	0.16485	0.0612
6. PPVT Raw Score	0.40084 *	0.20076	0.21865	0.17727	0.17563	0.22321	0.3640
7. ITPA Subtest 1	0.52653 *	0.12388	0.10737	0.36718	0.11150	0.18669	0.0865
8. ITPA Subtest 2	0.43674 *	0.09521	0.16547	0.34537	0.18399	0.11616	0.0298
9. ITPA Subtest 3	0.51283 *	0.22562	0.25338	0.32123	0.13279	0.20629	0.3594
10. ITPA Subtest 4	0.59209 *	0.11093	0.28539	0.24808	0.03327	0.05772	0.2649
11. ITPA Subtest 5	0.31974	0.12248	0.20400	0.03889	0.10031	0.13222	0.0376
12. ITPA Subtest 6	0.55536 *	0.03418	0.14571	0.02783	0.11803	0.07813	0.1033
13. ITPA Subtest 7	0.51033 *	0.22913	0.18615	0.09387	0.10588	0.21603	0.2083
14. ITPA Subtest 8	0.38499 *	0.07056	0.54676 *	0.15663	-0.00157	0.05937	0.1135
15. ITPA Subtest 9	0.24139	0.11494	0.10032	0.27371	0.07692	0.06782	0.5080
16. ITPA Subtest 10	0.31430 *	0.11916	0.28953	0.34747	0.16439	0.12054	0.0398
17. APT Subtest 2	0.29218	0.26093	0.41614	0.24362	0.12195	0.73178 *	0.1287
18. APT interview	0.19763	0.15181	0.07545	0.08276	0.85144 *	0.10073	0.0782
19. APT Subtest 5	0.14229	0.87163 *	0.22299	0.19390	0.18250	0.19276	0.1406
20. APT Total (2) ²	0.28363 2.5787	0.49670	0.37313	0.24027	0.27240	0.58770 *	0.1406

*Factor loadings used to identify the factors

¹The principal component solution was for ten factors but two factors are not shown in this table, hence the slight discrepancy between last column and the actual total sum of squares of the eight factors

²Total score of three APT subtests--variables 17, 18, 19.

of the APT interview on body parts. The other factors were "visual perception" (factor four), "auditory memory" (factor seven), and "verbal expression" (factor eight).

The communalities shown in the last column of TABLE 6-2 show that the eight factors altogether account for a very large proportion of the variance of the three APT tests--variables 17, 18, 19; i.e., these three subtests have very high reliability in terms of the eight factors. The next highest communality was found in the ITPA Subtest three--vocabulary (auditory association).

Analysis of Variance of the Factor Scores

An analysis of variance was made on each of the eight factor scores and results are shown in ATTACHMENT 6-1. The results on three factors were significant at 0.005 and one at 0.10. The level 0.10 was considered significant because the variables were not direct measurements and because of the wide range of significance levels. TABLE 6-3 gives the factor means for each group and the levels of significance for each factor from the analysis of variance.

The Q method¹ of detecting differences² between pairs of means was applied first to those results with significant F's in the Analysis of Variance, then to those with nonsignificant F's. The sections that follow discuss the results of the Q method of paired comparisons, beginning with factors with significant F's in the analysis of variance.

¹Snedecor, G. W. and William Cochran, Statistical Methods, the Iowa State University Press, Ames, Iowa, 1967, p. 272.

²The Q method is based on the studentized range $Q = (\bar{x}_{\max} - \bar{x}_{\min}) / \sqrt{s^2/n}$. It has the property that if some or all of the differences between pairs of means are tested, the probability that no erroneous claim of significance will be made is $\geq .95$.

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TABLE 6-3

FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION
PROJECT UNDER THE NORMAL DISTRIBUTION $N(0,1)$ (1), SIGNIFICANCE LEVELS
FROM THE ANOVA AND DIFFERENCE CRITERIA IN PAIRWISE COMPARISONS

Group	n	Factor							
		1	2	3	4	5	6	7	8
		Vocabulary	Reasoning	Visual Perception	General Reception	Identifying Body Parts	General Cognitive Skills	Auditory Memory	Verbal Expression
Package	40	+0.223	+0.031	-0.008	+0.070	+0.095	+0.222	+0.065	-0.107
TV-HV	37	-0.064	+0.289	+0.056	+0.267	+0.089	+0.289	+0.024	-0.037
TVonly	44	+0.040	-0.272	-0.109	+0.153	-0.174	-0.526	+0.066	-0.219
Comparison	45	-0.184	+0.000	+0.068	-0.432	+0.011	+0.078	-0.143	+0.340
All Groups	166	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Significance: (2) p		NS	0.10	NS	0.0005	NS	0.0005	NS	0.0005
$S_{\bar{x}}^2$		0.007	0.012	0.001	0.024	0.004	0.035	0.018	0.002
$S_{\bar{x}}$		0.083	0.109	0.031	0.154	0.063	0.187	0.122	0.044
D(3) criterion		0.306	0.402	0.114	0.568	0.234	0.690	0.450	0.162

(1) Under a normal distribution with mean zero and standard deviation one.

(2) From the ANOVA tables in ATTACHMENT NO. 6-1.

(3) The criterion $D = Q_{0.05} S_{\bar{x}}$ where Q is the studentized range $Q = (\bar{x}_{\max} - \bar{x}_{\min}) / s_{\bar{x}}$ and $Q_{0.05}$ is read from the table of Upper 5% Percentage Points, Q , in the Studentized Range. $Q_{0.05}$ for degrees of freedom 4, 166 is 3.69.

General Reception, Factor Four

The four means on the factor "general reception" were significantly different under the Analysis of Variance, with $P < .0005$. On a normal distribution with mean zero and variance equal to one, the TV-HV had a mean of 0.267 while the comparison group had a mean of -0.432. By the Q method, the criterion for the difference between any two means is 0.568. (See TABLE 6-3 for the Q method computation of least significant difference.) The four means were arranged in ascending order in TABLE 6-4.

TABLE 6-4

PAIRWISE COMPARISON OF THE FOUR TREATMENT MEANS ON "GENERAL RECEPTION"

(4)	(1)	(3)	(2)
Comparison	Package	TVonly	TV-HV
-0.432	+0.070	+0.153	+0.267

The nonsignificant difference is indicated by a line connecting the means with no significant difference. The same procedure will be applied to the rest of the comparisons. Thus, any two means not connected by a line indicate a significant difference at the 0.05 level. Hence, in "general reception or understanding", the three groups in the ECE program did not differ significantly, but scored higher than the comparison group; while the package group did not differ significantly with the comparison group, the latter scored significantly lower than the TVonly and TV-HV.

General Cognitive Skills, Factor Six

TABLE 6-5 shows the ordered means. By the Q method, the difference criterion was 0.690. The table shows that the means of the package, the TV-HV, and the comparison groups differ only by chance. However, the TV-HV and the package groups scored significantly higher than the TVonly.

TABLE 6-5

PAIRWISE COMPARISON OF THE FOUR TREATMENT
MEANS ON "GENERAL COGNITIVE SKILLS"

(3)	(4)	(1)	(2)
TVonly	Comparison	Package	TV-HV
-0.526	+0.078	+0.222	+0.289

Verbal Expression, Factor Eight

Factor eight ("verbal expression") had a significant F but this time the comparison group scored the highest. TABLE 6-6 indicates the significance of differences, in a pairwise comparison.

TABLE 6-6

PAIRWISE COMPARISON OF THE FOUR TREATMENT
MEANS ON "VERBAL EXPRESSION"

(3)	(1)	(2)	(3)
TVonly	Package	TV-HV	Comparison
-0.219	-0.107	-0.037	+0.340

The difference criterion was 0.162. There were two pairs with differences lower than this value. The comparison group was significantly the highest. This result was consistent with a related result for the ITPA Subtest 5 discussed in Technical Report No. 4.

Reasoning, Factor Two

"Reasoning" (Factor Two) is worth mentioning since F was significant at 0.10. On this factor the TV-HV group scored the highest, while the TV only scored the lowest. Pairwise comparisons are shown in Table 6-7.

TABLE 6-7

PAIRWISE COMPARISON OF THE FOUR TREATMENT
MEANS ON "REASONING"

(3)	(4)	(1)	(2)
TV only	Comparison	Package	TV-HV
-0.272	0.000	+0.031	+0.289

The difference criterion was 0.402. The table shows that in "reasoning" the TV-HV, the package, and the comparison groups did not differ significantly and were higher than the TV only group. The package group, however, did not differ significantly with the TV only on the one hand, and the comparison group on the other. What may be said is that the TV-HV scored significantly higher than the TV only, but not significantly higher than the comparison and the package groups.

Vocabulary, Factor One

Since the Q method is not restricted solely to means with significant F's, it was applied to the remaining four factors which did not yield significant F's in the Analysis of Variance.

TABLE 6-8
PAIRWISE COMPARISON OF THE FOUR TREATMENT
MEANS ON "VOCABULARY"

(4)	(2)	(3)	(1)
Comparison	TV-HV	TV only	Package
-0.184	-0.064	+0.040	+0.223

For "Vocabulary" the difference criterion was 0.306. This difference showed that the package group scored significantly higher than the comparison group which did not differ significantly from the TV-HV and the TV only. This result was partly consistent with that of the PPVT because the package group also scored highest in the PPVT (See Technical Report No. 2). However, in the PPVT, the TV-HV came very close to the package while the TV only was close to the comparison group. It was at this point that a re-examination of the factor loadings of the vocabulary factor on the variables was prompted. The Factor One column of Table 6-2 shows that the "vocabulary" factor had high loadings on most ITPA subtests with a relatively lower loading on the PPVT. The PPVT is a picture vocabulary test or a vocabulary test not necessarily requiring to relate concepts or to communicate. On the other hand the ITPA subtests (1, 3, 4, 6, and 7) were communication oriented

requiring relationship between concepts. Whatever small portion (about 16%) of the PPVT variance of the score which had to do with communication or relating concepts was apparently "extracted", and together with the communication aspects of the ITPA subtests mentioned, accounted for the high loading on the "vocabulary" factor score. Hence, it seemed appropriate to qualify the "vocabulary" label of factor one and call it "vocabulary in relating concepts and communication". If this is the case, it may be said that in contrast with the other three groups, the package group acquired a "higher-order vocabulary" level--namely, one which relates concepts, in contrast with mere labeling or naming pictures as in the PPVT.

Visual Perception, Factor Three

On "visual perception" the difference criterion was 0.114; the package, TV-HV and the comparison groups did not differ significantly; the package, which was the lowest among these three groups was not significantly different from the TV only; but the TV-HV and the comparison groups were significantly higher than the TV only.

TABLE 6-9

PAIRWISE COMPARISON OF THE FOUR TREATMENT
MEANS ON "VISUAL PERCEPTION"

(3)	(1)	(2)	(4)
TV only	Package	TV-HV	Comparison
-0.109	-0.008	0.056	0.068

Identifying Body Parts, Factor Five

On identifying body parts, the package group had the highest mean, with the TVonly at the bottom. The difference criterion was 0.232. Applying this value, it would be seen that the package, TV-HV and comparison groups were not significantly different from one another. However, the package and TV-HV had significantly higher means than the TVonly, in identifying body parts.

TABLE 6-10

PAIRWISE COMPARISON OF THE FOUR TREATMENT
MEANS ON "IDENTIFYING BODY PARTS"

(3)	(4)	(2)	(1)
TVonly	Comparison	TV-HV	Package
-0.174	0.011	0.089	0.095

Auditory Reception, Factor Seven

With "auditory memory", the difference criterion was 0.450. It was readily seen from TABLE 6-3 that there was no pair with a difference greater than or equal to 0.450. The difference between the extreme values for the comparison group and the package/TVonly was 0.209.

Auditory memory was the only factor which didn't show any significant difference in both the analysis of variance and the pairwise comparison based on the Q method.

Summary and Conclusion

The results of the factor analysis indicated the effectiveness of the ECE program on at least a few factors. With the exception of "verbal expression" in which the comparison group scored the highest, the ECE subjects had higher factor scores. In general, either the TV-HV, or both the TV-HV and package groups scored the highest. The three factors with significant F results in favor of the ECE groups were General Reception or Understanding ($P < .0005$), General Cognitive Skills ($P < .0005$), and Reasoning ($P < .10$). In verbal expression, the comparison group's mean score was significantly greater than those of the other three groups. In the "vocabulary of communication and relating concepts", the package group scored significantly higher than the comparison group, while the TV-HV and TV only placed between the two extremes appeared more likely to be as low as the comparison group. "Visual perception" was not a good discriminant. The package, TV-HV, and comparison groups did not differ significantly, but the TV only was definitely lower than the TV-HV or the comparison group. In "identifying body parts", the package and the TV-HV were definitely higher than the TV only. The bar graphs in Attachment 6-2 consist of a visual summary of the factor score means of the four groups.

ATTACHMENT 6-1

ANALYSES OF VARIANCE OF FACTOR SCORES

TABLE 1

ANALYSIS OF VARIANCE OF FACTOR SCORES ON
VOCABULARY (FACTOR ONE)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	3.755	3	1.251	1.948	NS
Error	104.090	162	0.642		
Total	107.845	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 2

ANALYSIS OF VARIANCE OF FACTOR SCORES ON
REASONING (FACTOR TWO)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	6.417	3	2.139	2.316	.10
Error	149.566	162	.923		
Total	155.983	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 3
ANALYSIS OF VARIANCE OF FACTOR SCORES ON
VISUAL PERCEPTION (FACTOR THREE)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	0.861	3	0.287	0.411	NS
Error	113.078	162	0.098		
Total	113.939	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 4
ANALYSIS OF VARIANCE OF FACTOR SCORES ON
GENERAL RECEPTION (FACTOR FOUR)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	12.309	3	4.103	8.677	.0005
Error	76.596	162	0.472		
Total	88.905	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 5
ANALYSIS OF VARIANCE OF FACTOR SCORES ON
IDENTIFYING BODY PARTS (FACTOR FIVE)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	2.008	3	0.669	0.791	NS
Error	136.974	162	0.845		
Total	138.982	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 6
ANALYSIS OF VARIANCE OF FACTOR SCORES ON
GENERAL COGNITIVE SKILLS (FACTOR SIX)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	17.570	3	5.856	7.034	.0005
Error	134.874	162	.832		
Total	152.444	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 7
ANALYSIS OF VARIANCE OF FACTOR SCORES ON
AUDITORY MEMORY (FACTOR SEVEN)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	1.309	3	0.436	0.967	NS
Error	73.082	162	0.451		
Total	74.391	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

TABLE 8
ANALYSIS OF VARIANCE OF FACTOR SCORES ON
VERBAL EXPRESSION (FACTOR EIGHT)

Source of Variation	SS	D.F.	MS	F	P
Treatment ¹	7.869	3	2.623	6.771	.0005
Error	62.754	162	0.387		
Total	70.623	165			

¹Treatment: Package, TV-HV, TVonly, Comparison group.

ATTACHMENT 6-2

BAR GRAPHS OF EIGHT FACTOR SCORE MEANS OF
FOUR GROUPS OF CHILDREN IN THE EARLY
CHILDHOOD EDUCATION PROJECT

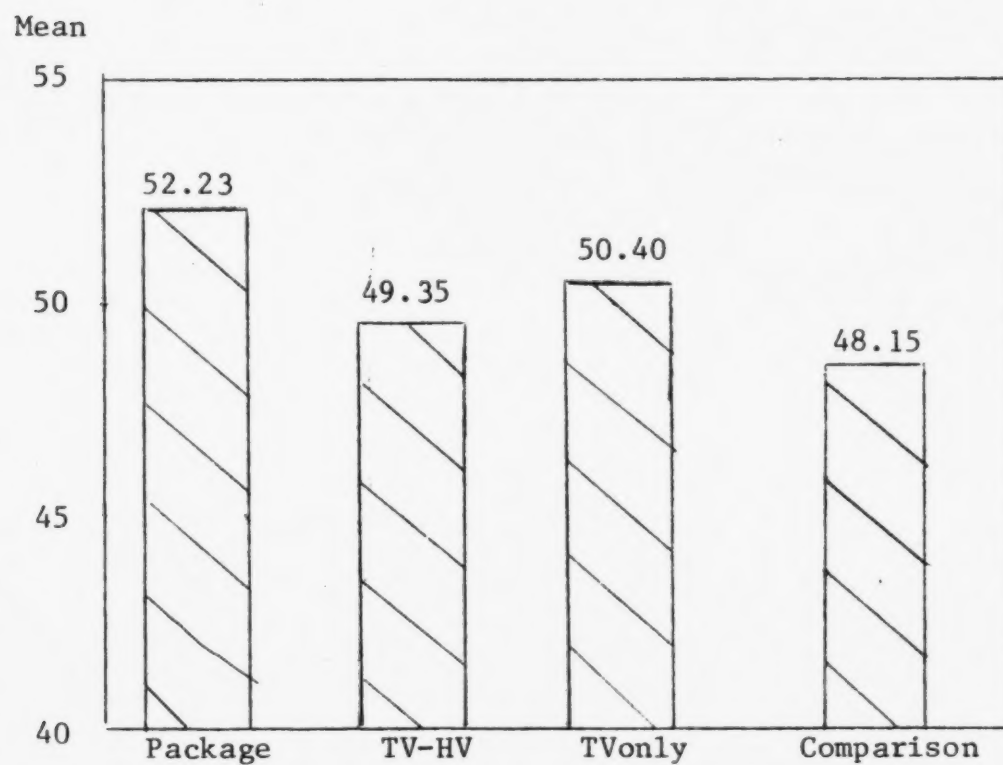


FIGURE 1

VOCABULARY (FACTOR ONE) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION N (50,10)

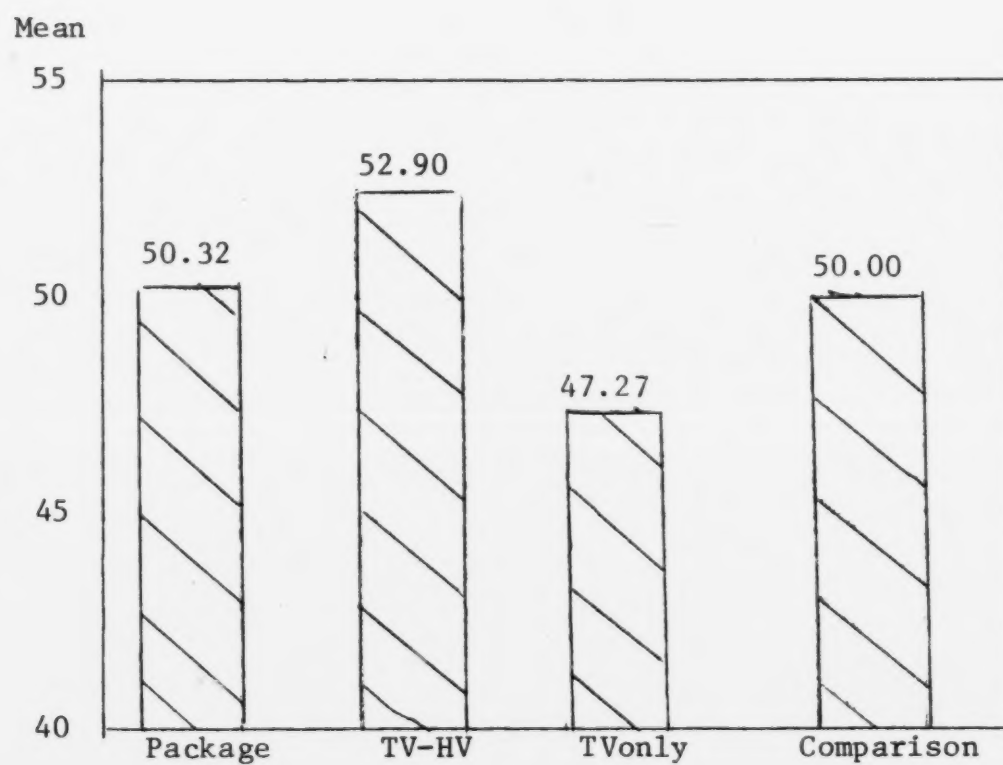


FIGURE 2

REASONING (FACTOR TWO) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION N (50,10)

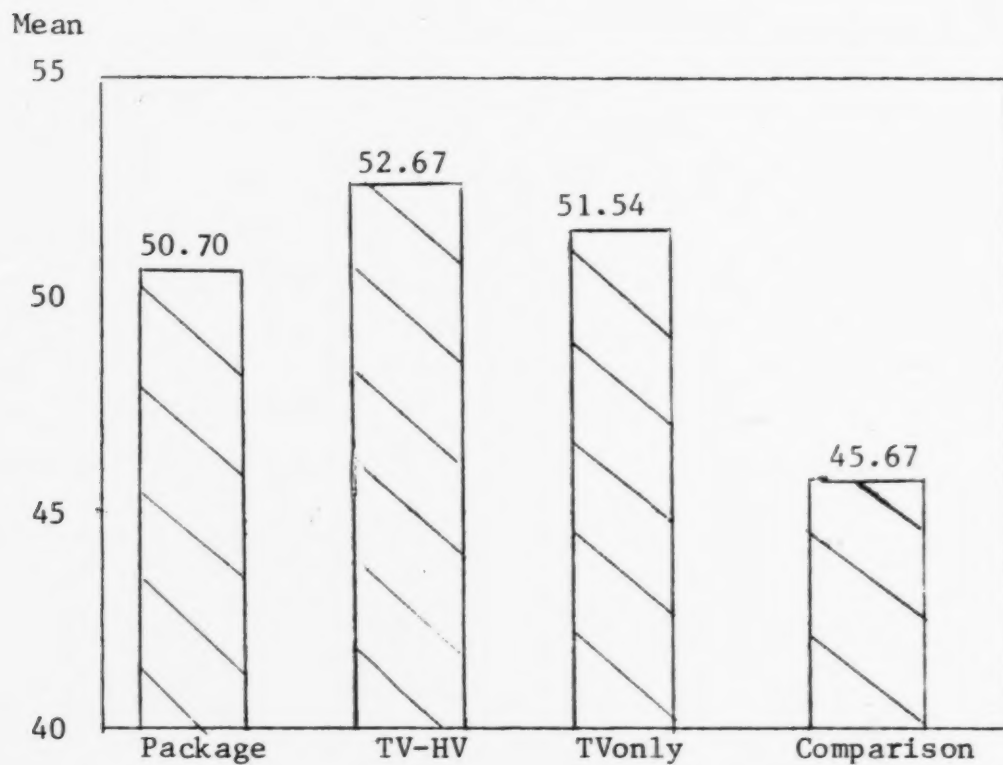


FIGURE 3

GENERAL RECEPTION (FACTOR FOUR) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION $N(50,10)$

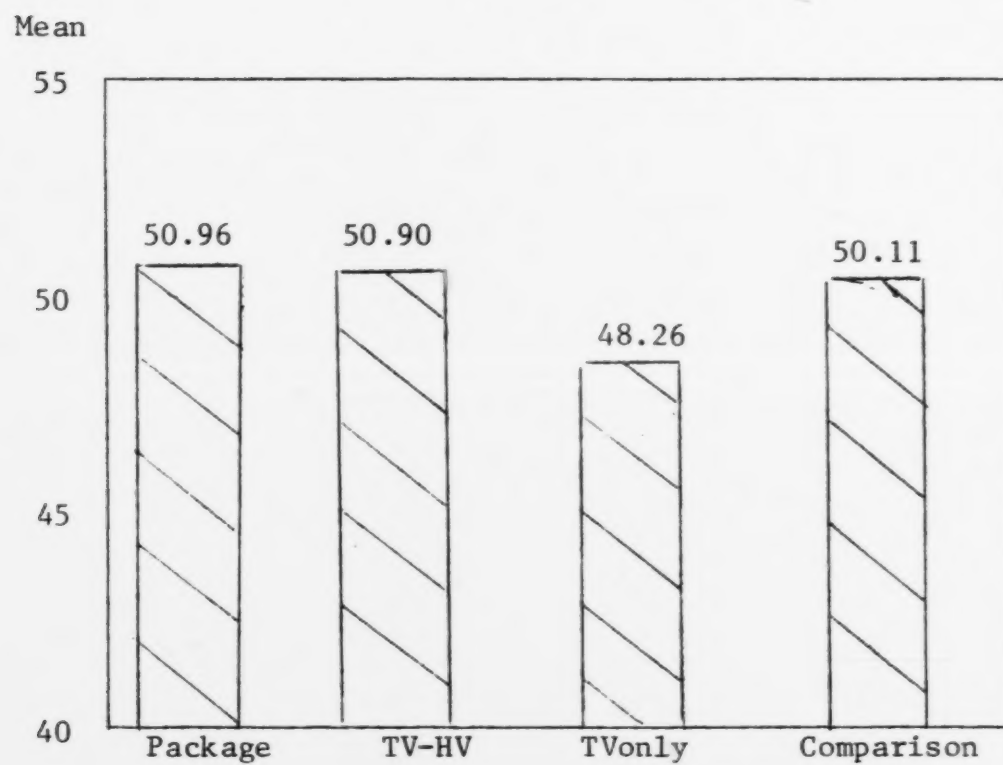


FIGURE 4

IDENTIFYING BODY PARTS (FACTOR FIVE) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION $N(50,10)$

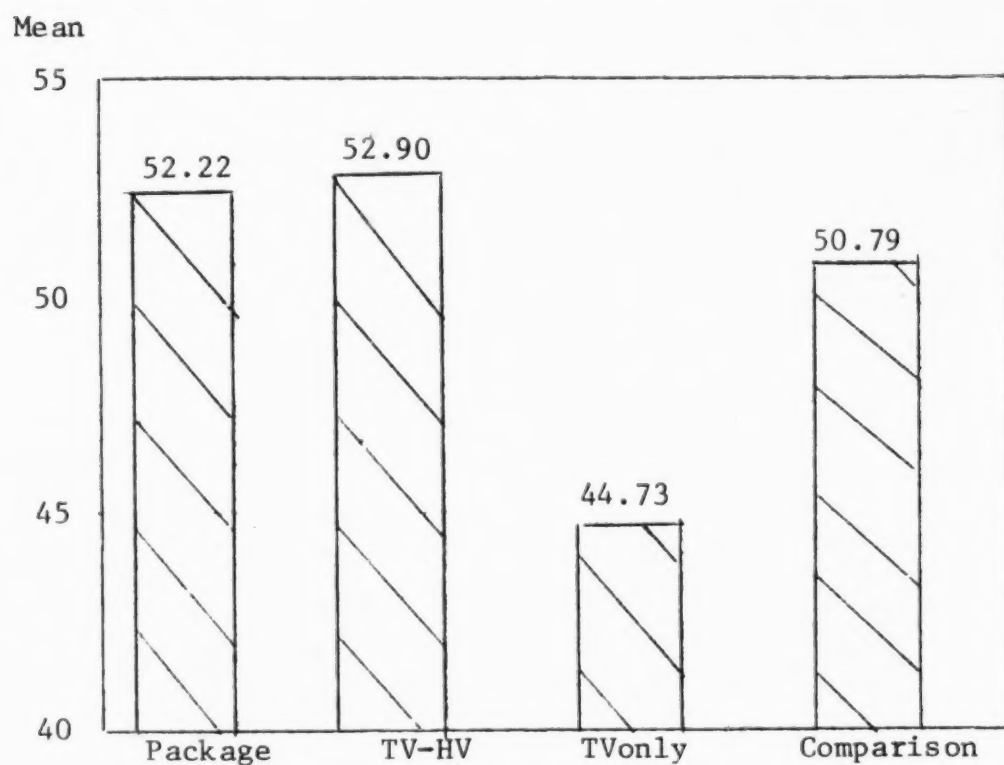


FIGURE 5

GENERAL COGNITIVE SKILLS (FACTOR SIX) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION $N(50,10)$

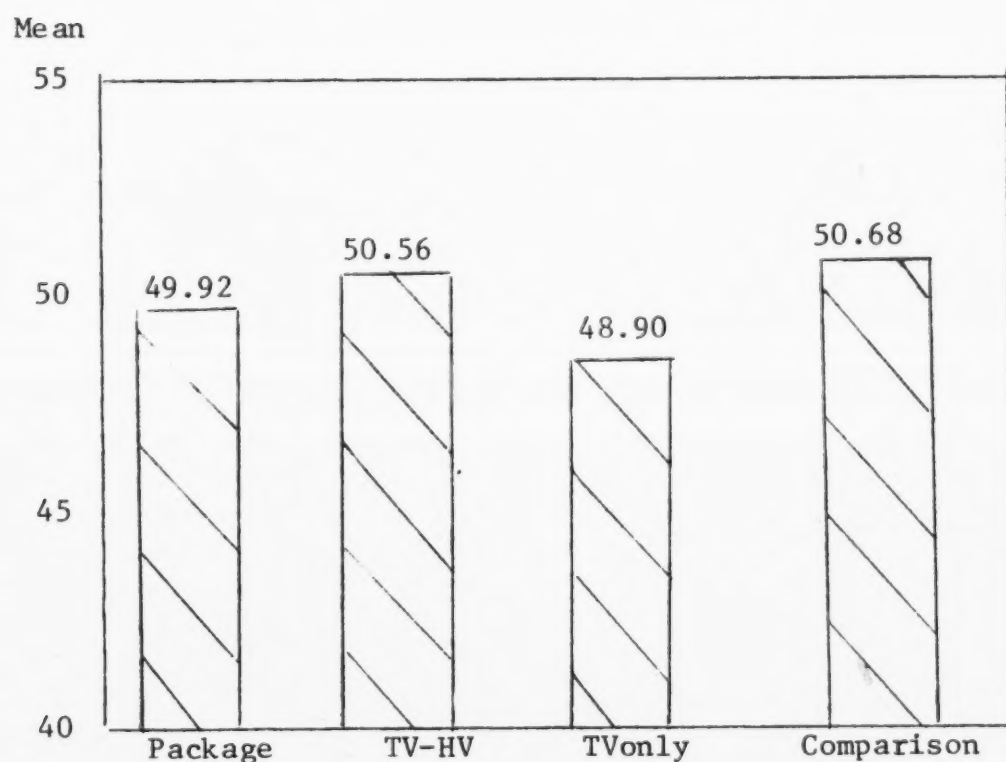


FIGURE 6

VISUAL PERCEPTION (FACTOR THREE) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION $N(50,10)$

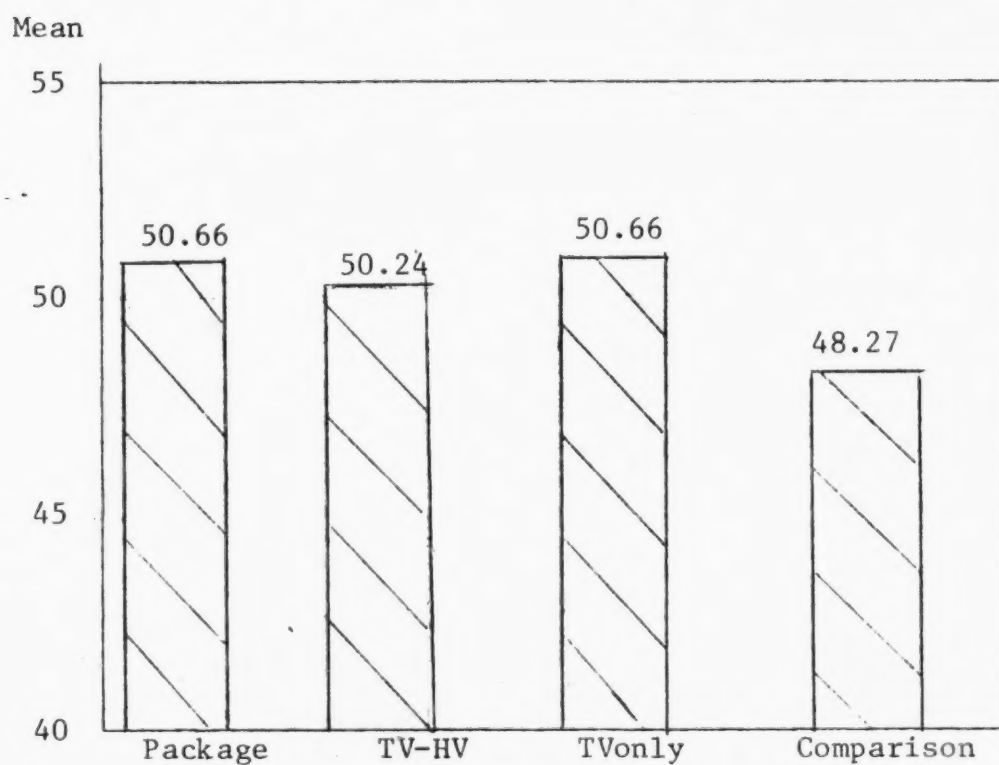


FIGURE 7

AUDITORY MEMORY (FACTOR SEVEN) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION $N(50,10)$

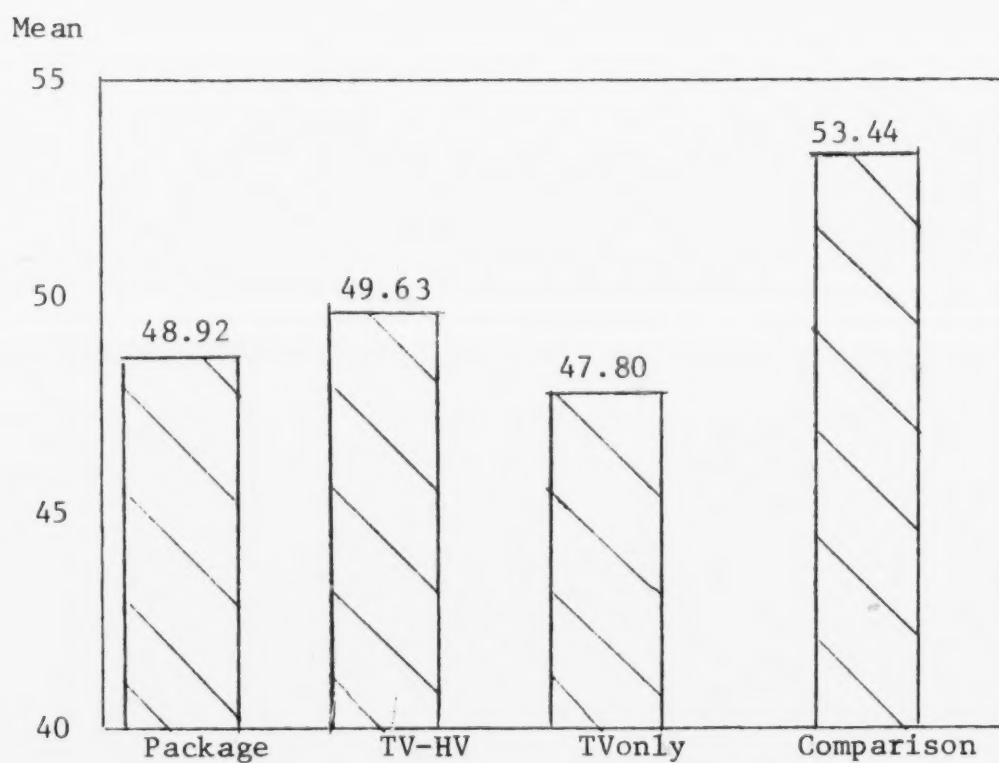


FIGURE 8

VERBAL EXPRESSION (FACTOR EIGHT) -- FACTOR SCORE MEANS OF FOUR GROUPS OF CHILDREN IN THE EARLY CHILDHOOD EDUCATION PROJECT, UNDER THE NORMAL DISTRIBUTION $N(50,10)$